MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2015/2016

ECE2056 – DATA COMMUNICATIONS AND NETWORKING

(ALL GROUPS)

2 JUNE 2016
2:30 P.M. - 4:30 P.M.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This examination paper consists of 8 pages with 4 questions only.
2. Answer **ALL** the 4 questions. The distribution of marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.

Question 1 (33 marks)

(a) Using the internet configuration in Figure Q1(a), show the layers of the TCP/IP protocol suite and the flow of data when two hosts, one in the KL office and the other in the Cyberjaya office, exchange messages.

[6 marks]

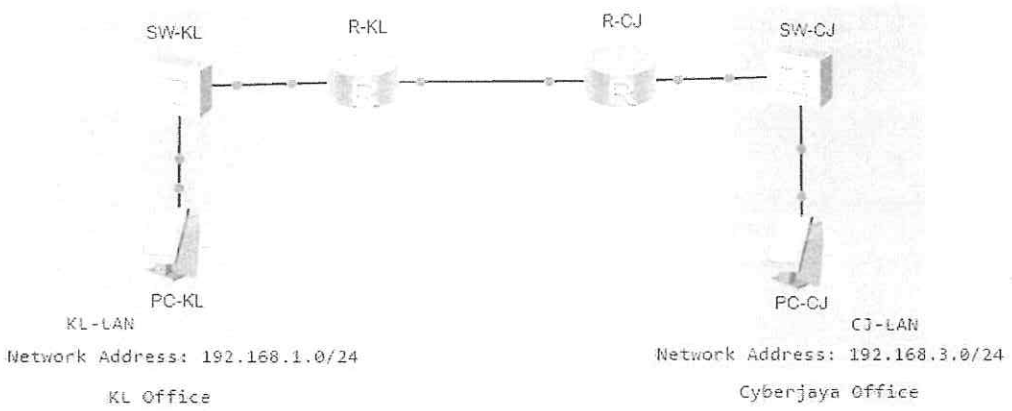

Figure Q1(a)

(b) Match the following to one of the layers in the TCP/IP protocol suite:

(i) Creating user datagrams

[1 mark]

(ii) Handling frames between adjacent nodes

[1 mark]

(iii) Transforming bits to electromagnetic signals

[1 mark]

(c) Why does a circuit-switched network need end-to-end addressing during the setup and teardown phases? Why are no addresses needed during the data transfer phase for this type of network?

[3 marks]

Continued...

(d) Figure Q1(d) shows the routing table of a router in a datagram network. Find the output port for packets with the following destination addresses:

(i) Packet 1: 5678
(ii) Packet 2: 9012
(iii) Packet 3: 1234

Destination address	Output port
1234	E3
3456	E2
5678	E4
7890	E2
9012	E1

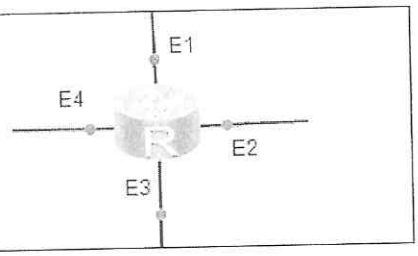

Figure Q1(d)

[3 marks]

(e) Compare and contrast byte-stuffing and bit-stuffing.

[4 marks]

(f) Consider a communication system with data-link layer applying the Stop-and-Wait protocol. Draw the flow diagram and explain the following scenarios:

(i) Frame 0 is sent, but lost.

[2 marks]

(ii) Frame 0 is resent and acknowledged.

[2 marks]

(iii) Frame 1 is sent and acknowledged, but the acknowledgment is lost.

[2 marks]

(iv) Frame 1 is resent and acknowledged.

[2 marks]

(g) With the aid of a diagram, briefly explain the Challenge Handshake Authentication Protocol (CHAP).

[6 marks]

Continued...

Question 2 (22 marks)

(a) Figure Q2(a) shows the standard procedure of the Carrier Sense Multiple Access with **Collision Detection** (CSMA/**CD**) protocol.

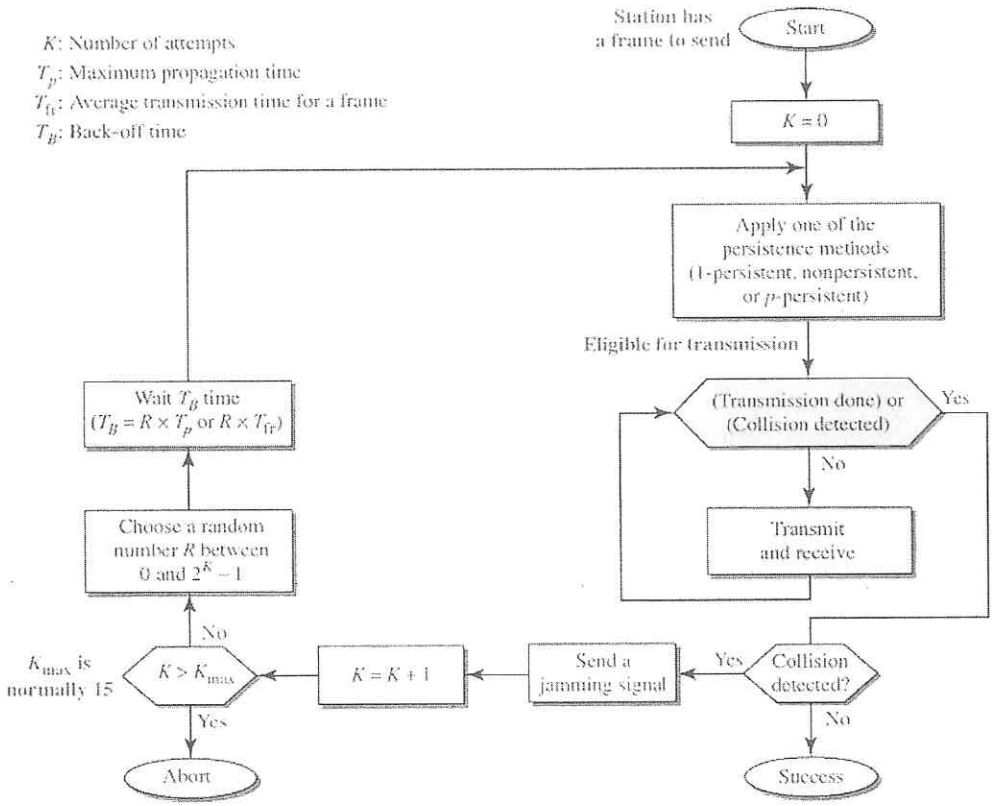

Fig. Q2(a)

(i) A network using CSMA/CD has a bandwidth of **100 Mbps**. The maximum propagation time (including the delays in the devices and ignoring the time needed to send a jamming signal) is **25.6 µs**. What is the minimum size of the frame (in bytes)?

[2 marks]

(ii) Suppose a station in the network can tolerate a maximum of 15 attempts (i.e. $K_{max} = 15$), what is the maximum waiting time due to back-off as a result of a single collision? Assume **1-persistent** method is used.

[4 marks]

Continued...

(iii) Now suppose the **non-persistent** method is used, which deploys the same random back-off technique that is triggered after detecting collision. At first, the station senses a busy channel and it back-offs for a random period of time. Then it senses the channel being idle and transmits the frame, but unfortunately it experiences collision this time. After another round of random back-off, the transmission is finally successful. Calculate the maximum waiting time as a result. Assume that $K_{max} = 15$.

[3 marks]

(iv) Based on the results above, compare between the 1-persistent and non-persistent methods.

[2 marks]

(b) Suppose the cable length connecting two computers on a **Standard Ethernet** Local Area Network (LAN) is 2500 m. Take the propagation speed of a signal in the cable as 2×10^8 m/s.

(i) What is the minimum Ethernet frame size?

[1 mark]

(ii) Calculate the propagation delay of the signal, T_p.

[2 marks]

(iii) Calculate the transmission delay of an Ethernet frame of the smallest possible size, T_{fr}.

[2 marks]

(iv) Calculate the number of frames that can fit on the cable, a.

[2 marks]

(v) Calculate the efficiency of the Standard Ethernet in this example.

[2 marks]

(c) Describe two strategies in Carrier Sense Multiple Access with **Collision Avoidance** (CSMA/CA) that are used to avoid collision.

[2 marks]

Continued...

Question 3 (22 marks)

(a) Figure Q3(a) below shows three Local Area Networks (LANs) that are interconnected by routers. Subnetting is not implemented. Given that the Internet Protocol (IP) addresses at interface **f1** of router **R1**, and interface **f2** of router **R2** are 170.120.120.1 and 85.120.120.2, respectively, and that of host H2 is 213.120.120.3.

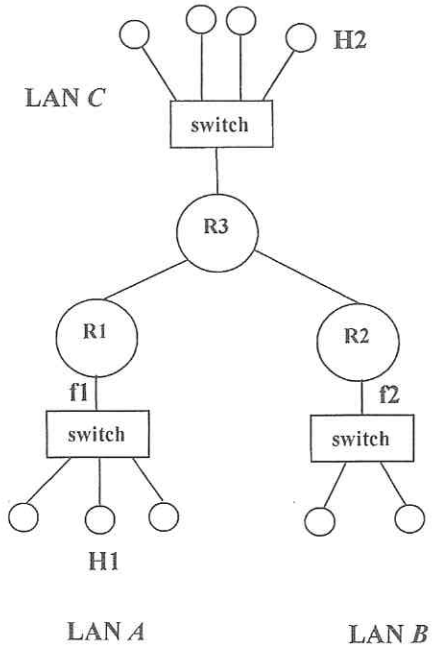

Figure Q3(a)

Determine the IP address and address class for the followings:

(i) LAN *A* network,

[2 marks]

(ii) LAN *B* network,

[2 marks]

(ii) LAB *C* network, and

[2 marks]

(iv) Host H1 with host ID of 1010_2.

[2 marks]

(b) (i) What is subnetting and under what circumstances are subnetting needed?

[4 marks]

(ii) A company with a class B address needs at least 12 subnetworks. Deduce the maximum number of hosts in a subnet, and find the subnet mask required.

[5 marks]

Continued...

(c) How many bits do IPv4 and IPv6 use, respectively?

[2 marks]

(d) An IPv6 address is given as E1C7:2468:0000:0000:0701:DA34:0000:F563. Identify whether the following simplified IPv6 presentations are correct or incorrect? Briefly explain your answer.

(i) E1C7:2468:0:0:701:DA34:0:F563

[1 mark]

(ii) E1C7:2468::701:DA34:0:F563

[2 marks]

Continued...

Question 4 (23 marks)

(a) A large organization with a large block address (101.33.184.0/21) is split into one medium-size company using the block address (101.33.184.0/22) and two small organizations.

(i) If the first small company uses the block (101.33.188.0/23), what is the remaining block that can be used by the second small company?

[5 marks]

(ii) Explain how the datagrams destined for the two small companies can be correctly routed to these companies if their address blocks are still part of the original company.

[6 marks]

(b) An IP fragment has arrived with an offset value of 50. How many bytes of data were originally sent by the source before the data in this fragment?

[3 marks]

(c) In a network using the Selective-Repeat protocol with $m = 4$ and the sending window of size 8, the value of variables are $S_f = 62$, $S_n = 67$, and $R; = 64$. Packet 65 has already been acknowledged at the sender site; packets 65 and 66 are received out-of-order at the receiver site. Assume that the network does not duplicate the packets.

(i) What are the sequence numbers of pending data packets (in transit, corrupted, or lost)?

[3 marks]

(ii) What are the acknowledgment numbers of pending acknowledgement (ACK) packets (in transit, corrupted, or lost)?

[3 marks]

(d) Assume a Transmission Control Protocol (TCP) server is expecting to receive byte 6001. It receives a segment with the sequence number 6001 that carries 2000 bytes. If the server has bytes 4001 to 5000 to send, what should the reaction of the TCP server be to this event? Can you justify the reaction?

[3 marks]

End of paper